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WOOLEN AND WORSTED LOOMFIXING

A BOOK

FOR LOOMFIXERS

AND

ALL WHO ARE INTERESTED IN THE PRODUCTION OF PLAIN AND FANCY WORSTEDS AND WOOLENS

ALBERT AINLEY

LAWRENCE, MASSACHUSETTS
1900

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PREFACE.

The particular subject on which this work treats is "The Knowles Heavy Woolen Loom" but the subject matter in general, with the exception of certain specific points is applicable to almost any woolen loom. The troubles, causes, and treatment being very much the same in general on one loom as on another.

It is not intended in this book to explain how the different looms are made nor what the different parts are for, as that is unnecessary to a loomfixer, and furthermore would require too large a volume to suit the author's purpose; but to discuss as much as possible, the various problems with which a fixer has to grapple.

The author's first intention in this line was simply to make notes of all the various remedies, little tricks etc., valuable to a loomfixer, that should come to his knowledge, either through instruction, experience, observation or in any other way while in the prime of life so that in future years, when his memory begins to fail him, as it has done to many men who were good fixers in their day, he will have something to refer to. And it may be said here, after having made up his mind to pub-

lish the work in book form, that he would have given a good deal, earlier in life to have known some of the things herein contained.

It will no doubt be worth its cost many a time over to young fixers who have not yet acquired the experience of an older hand, and it may be used at least as a reminder to an old fixer.

Of course if a man is not a loomfixer, all the books ever published would not make him one. If he cannot fix looms without a book, he cannot do so with one. But any one who has not had the experience, or whose mind is too occupied with something else, some trouble with another loom for instance, so that at the time being, he does not think of things of vital importance, may find a discourse on the subject to save him a great amount of experimenting. Or it may bring to mind some remedy which he had used successfully on former similar occasions.

There are two things that are absolutely necessary to the making of a good loomfixer: they are gumption and experience. The latter, though a necessary assistant to the former can never be sufficiently acquired to take its place altogether.

The work of a loomfixer may be classed into two parts, viz: Mental and physical; a large

proportion of the fancy loomfixer's work being of the former kind; comprising principally, such things as hunting for the causes of the different things that will occur on a section of looms. Trying to get a good smooth pick on a loom, which by the way is sometimes a very difficult thing to do. Trying to remedy a case of filling cutting; having trouble with the head motion, harness skips, for instance. Loom-banging through uneven picking power; unsteady box-motion; shuttle going crooked etc. These things at times will tax the ingenuity of the best fixer that ever attempted to learn the language of a loom. It is this part of the loomfixer's work which the author has herein attempted to discuss.

The manual part of a loomfixer's work, comprising such things as replacing broken pickersticks, pickers, and other parts are things on which it is not necessary to dwell to any great extent, though at times it requires considerable skill to do even that part of his work to the best advantage; in fact there is skill in everything. Even the man who uses the pick and shovel may become so skillful at it that he can do perhaps twice the amount of work with the same exertion that another man would have to use who was not accustomed to that kind of work. He would know just where to dig in

with his pickaxe and at what angle, etc. which the unskilled would not have learned.

Generally speaking (but not always by any means), it is an easy matter to fix a loom after the cause of the trouble has been located ; but whenever it is thought advisable, not only is the probable cause pointed out, but suggestions are offered as to the best way to go about fixing it.

While there may be some important points in loomfixing omitted through oversight, there are a great many things left out purposely. Things which all loomfixers must necessarily know about, consequently there is no need to take up the space in this book with them. Someone has said that a loom talks, but alas! how difficult is its language to learn! A young fixer may think he understands it thoroughly but as he grows older and begins to see a little deeper into things, he finds out that he does not understand it as well as he thought he did, and bye and bye he sometimes begins to think he does not understand it at all.

Of the origin or history of weaving the author has got nothing to say, but the progress that has been made in the art of manufacturing in general during the last thirty or forty years is such, that now we find machinery almost entirely automatic. Cotton looms are made at

the present day that will run for more than an hour without the attention of a weaver and produce perfect cloth.

One cannot think seriously of these things without the thought suggesting itself that the time has come when women and children, yes and even men, should not be required to work and be confined in the mill ten hours a day to earn a scanty living. If anyone thinks that that is not too long, let him look into the weary, careworn faces of the mill operatives as they come out at night or before they get out into the open air, and if he is a man who tries to live up to the divine law he will alter his opinion.

This book, to be used to the best advantage, should be kept with you at your work where it will be handy and whenever you have any trouble with anything for which at the time you do not think of a remedy, just turn to that subject and see what is said on it. The chances are that if you do not find any satisfactory solution in it, there will be something suggested that will help you to invent one.

A. AINLEY,

Lawrence, Mass.

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CHAPTER I.

THE BELT.

Belts should not be put on to a loom in any manner, whichever end comes first ; they should be put on so that the splicings on the outside will follow. This is contrary to the teachings of some writers on this subject. They claim that the lap on the inside of the belt should go with the pulley ; if so, the end of the lap on the outside would lead, and that is wrong, for the simple reason that, on account of the outside of the belt where it is passing around the pulley being considerably tighter than the inside, the laps whenever they do start at all do so on the outside, consequently the laps on the outside should not lead, but follow, so as to avoid contact with the air, which of itself is sufficient to open out the splice after it has once started. The statement that the slipping of the belt would cause the lap to roll is all nonsense, because if such a thing was possible in one direction it would be in the other. The driving pulley would do it in one direction and the driven pulley would do it in the other.

The question has often been asked "Which is the best side of a belt to run to the pulley?"

There is no doubt that the smooth side has a little greater pulling power than the flesh side, but the difference is very small indeed. The flesh side, being the shorter side, fits more snugly to the pulley, and belts that are run on that side will last longer than the other way,—in the writer's estimation.

TIGHT BELTS are no advantage to a loom, but rather a disadvantage to the steady running of it Any lurch or back-lash in the speed is communicated to the loom when the belt is too tight but if it is moderately slack the loom is not run so rigidly.

BELT DRESSING. If the belt is slipping it is not the best thing you can do to tighten it up, unless it is very slack. It should have the accumulation of dust, dried belt-dressing and flyings cleaned off the surface and some good dressing applied. The dressing in some cases seems to get dried on very quickly, leaving a dry, hard surface. When this is the case it should be well oiled; not with lubricating oil, but castor oil or Neat's foot oil or something of that nature that will make the surface soft and pliable but not soak it with grease.

Every fixer should have a hand card of fine wire tacked on to a block of wood for the pur-

pose of cleaning his belts, but it should not be used so hard as to make the surface rough. A rough surface does not pull as well as a smooth one if it is kept clean and soft. Cross belts very seldom need any attention as they are self-cleaning. They are the best on a loom.

It is a poor policy to lace loom belts, the ordinary belt fasteners are far better. In the first place they can be applied in less than a quarter of the time that it takes to lace one, they give less trouble and if properly applied will last a great deal longer. The belt should be hammered on to the clasp, not the clasp on to the belt, and care should be taken not to flatten it out or the belt would have a tendency to leave it when passing around the pulley.

THE FRICTION PULLEY.

The friction pulley plays a very important part in the running of a Knowles loom or perhaps any other loom where a friction pulley is used, especially on heavy work.

On some weaves where there are more harnesses changing places on one pick than on another, a poor friction will cause a loss of power and result in loom banging off.

Of course there are other things besides loss of power that will cause a loom to bang off, but

that subject is treated more fully later on. To overcome this trouble find out in the first instance whether it is the friction pulley or the belt that is slipping the most. This can be done in the following manner: take the shuttle out of the box, hold the brake lever down with your foot and start the loom up. Watch the loose pulley; if it stops you will know that the friction is holding and that the belt is slipping. But if it is the friction that is slipping, find out first (to use the fixer's term) if there is friction enough on. If not, draw it up a little closer. Next, see that the counter shaft is properly blocked so that it can't slide forward. If after seeing that these things are all right, the friction is still slipping, it is probably greasy. A greasy friction is an abomination and the best way to get over it, if it is badly soaked, is to take it off and have it recovered. Every mill should have spare friction pulleys so as to avoid waiting. If you prefer to use it a little longer, scrape the grease off with a straight edged scraper and rub some dry slacked lime into it and it will be good for a while longer. The above directions are also a good thing to follow in cases where the loom does not stop quickly enough. But first see that the wooden block in the casting at the end of the counter shaft is the proper thickness to hold the shaft

properly ; not to bind, but prevent it from slipping forward. Because, if when you start the loom the counter shaft should move forward, say one-twelfth inch, it would slide back the same amount when you stop it ; thus, if the friction is a little sticky the loom would be likely to run a couple of picks after you had tried to stop it.

Never scrub the leather on the friction pulley with sand paper, as that spoils its surface but does it no good.

TURNING IT DOWN. Whenever you put on a new friction pulley and after it has run a little while you are not satisfied with it, take the shaft out and examine the surface of the leather, and you will probably find that it only touches here and there ; consequently it does not get a good hold. In that case it should be put into a lathe and turned down good and true. You will then have a good friction after it has run a few days.

CHAPTER II.

THE PICKING MOTION.

The picking motion in general is a very sensitive part of a loom.

It requires a great amount of skill and gumption on the part of the fixer to adjust the different parts so as to work to the best advantage.

To write up an article of instruction on this subject is pretty sure to come in for a good share of criticism.

I have read articles on the subject in textile papers which, although I considered them very instructive and likely to infuse new ideas, another fixer on the same kind of looms would say the fellow didn't know what he was talking about.

Now, it is well known that most loomfixers have some system or rule whereby they set the shoes and other parts of the picking motion; but how few there are who are able to get a good smooth pick on every loom on their section after they have been used a few years, especially where the casting for repairs do not come from the loom works.

Owing to certain differences in the position or condition of the various parts which go to make up the picking motion of the loom, there can be no fixed rule for the setting of shoes. The shoe shaft may be bent or twisted a little, or the hole in the shoe may be a trifle out of true, etc. Such things will throw the curve of the shoe out of its proper position and I may say right here that a little difference in the shoe may make a great difference to the pick, especially on the short shoe No 86.

In many cases the rule that the fixer works by does not make proper allowance for these things, but they do try to counteract them in other ways which do not always come out right.

If the circle, or curve of the shoe is not in such a position as to give a smooth, steady stroke, it must follow that there will be unproportionate strain on some part of it. That extra strain, not being accomplished gradually but coming on suddenly, causes a jar which weakens the pick, thus causing the loom to bang off. Unless the position of the shoe is changed, it becomes necessary to lower the sweepstrap to gain more power. Again, it naturally follows that in putting on more power in this manner you are getting too near the wrong end of the lever (picking stick), which increases the jar; thus increasing the liability

to bang off. The consequences are an uneven pick, which causes filling kinking on certain classes of goods and a number of other troubles too numerous to mention. I will mention here one system generally used by fixers, some of whom taking them all through are good fixers.

They will set the shoes both alike so far as the distance is concerned, measuring from the back bearings. Next, they will set both shoe shafts the same distance below the cam shaft and set them level in all cases. Now this is where they make a mistake, as by setting the shoes according to that rule it becomes necessary in some cases to set the picking roll forward on one side more than the other in order to get both sides to pick together.

I will now give the method which I have found to give better satisfaction.

First, hang a plumb-line over the front of the cam shaft directly opposite the toe of the shoe, if it is the short shoe No. 86. This rule is for the style of looms that have a two to one gearing. Set the shoe just to touch the line on both sides. The long shoe, used on the equal geared looms, will come about an inch forward of the line, or a little more according to condition.

Then turn the shaft by hand until the picking rolls come within one-sixteenth inch of the

line, if they are not both alike make them so. Then measure the distance of the lay or edge of the shuttle-race from the breast beam ; turn the crankshaft one pick to the exact position it was in before, and set the next two rolls in the same way, that is, one sixteenth of an inch from the plumb-line. Be sure in the first instance to have all the rolls the same size.

Next set both sweep sticks in the same position on the pickerstick and get the sweep up to within two inches of the bunter.

It will now probably be found that, although everything is set the same on both sides, the pick does not start at the same time on both sides ; if they do, then all right. But if not, it shows that the circle of the shoes are not both alike, or at least not in the same relative position to the circuit of the rolls.

In this case do not begin to set the picking rolls different to get both sides to pick together, they are all right, it is the shoes that are wrong ; but to adjust matters so that they will come right requires a considerable amount of skill and gumption. In the first place take the side that is picking late and lower the shoe shaft at the back and raise it at the front. By so doing you will alter the position of the circle of the shoe, which will necessitate the shortening of the sweepstick a little, thus making it pick earlier.

If you cannot get it to start soon enough in this way, perhaps the best thing to do would be to try another shoe; or you may turn your attention to the other side and by doing just opposite to what you did before you may make it start a little later; which will tend to bring about the same results. I do not favor setting the back casting up any higher than the back rail if it can be avoided. I do not think it gives a very easy pick if it is raised up too much.

The same object may be accomplished by packing the shoe up on the front and down at the back with one or two thicknesses of tin on the side which is picking late, or visa versa on the other side, but to do that you would need to file the square hole out more on the opposite side to where you intend putting your packing.

As I said before, it requires sound judgment in doing these things so as not to go too far either way or you will effect the steadiness of the stroke.

When the pick is too slow at the commencement but makes up for lost time towards the latter part of the stroke, the reason is that the shoe is too high at the front in comparison with the back, or the back is too low in comparison with the front part of the shoe.

Looms having a pick of this description run in a sort of plunging manner but they usually give a good pick.

But if, on the contrary, the pick starts very suddenly at the commencement of the stroke, keeping very much the same speed all through, there will be a poor pick. It will pick as though it was going to drive the shuttle through the wall, but in reality it will scarcely get through in time to prevent the loom from banging off.

If you turn the loom slowly by hand a well regulated pick will start slowly at first and gradually increase in speed for about three-quarters of the way and then diminish the rest in the following manner. Take the measurement from the shuttle-race to the breast beam at the commencement of the pick, push the lay back one-fourth inch at a time, and the picker-stick at the top, or on a level with the picker,

For the	1st.	1-4	in.	should	have	moved	3-4 in.
" "	2nd.	"	"	"	"		3-4 in.
" "	3rd.	"	"	"	"	1	in.
" "	4th.	"	"	"	"	1	1-4 in.
" "	5th.	"	"	"	"	1	3-4 in.
" "	6th.	"	"	"	"	2	1-4 in.
" "	7th.	"	"	"	"	2	3-4 in.
" "	8th.	"	"	"	"	1	1-2 in.
" "	9th.	"	"	"	"	1	in.

If the pickerstick makes its stroke at or about that rate and does not give a smooth, easy pick, I should look for the cause anywhere rather than in the shoe.

In the first place the friction pulley or belt may be in poor condition. A loom will very rarely give a steady, even pick if the belt and friction is slipping.

The back support of the shoe shaft may have been neglected until the hole is worn to twice its proper size through the want of oiling, in which case we can hardly expect as steady a pick as we would like to have.

A poor pickerstick may cause a lot of annoyance in various ways. It will not only give a poor, uneven pick which is not to be depended upon, but, unless the spring is very strong, it will be slow in getting back and be liable to get caught in the boxes.

A badly shaped binder will also have its effect and cause the loom to bang off unless the power is greater than would otherwise be necessary. If the binder-pinhole in the boxes is badly worn at the top it will have about the same effect as a poorly shaped binder.

Now we will suppose the pinhole is worn out, say about one-eighth of an inch. The binder will wabble at both ends when the shuttle is in the box. The shuttle will get in the top box

easier under these conditions when there is one in the second box than it would if the second box was empty. Because, when one shuttle is in, it holds the pin out to its extent and holds off the pressure of one spring, consequently the check on the shuttle is not always the same. The result may be either the shuttle rebounding in one instance or not getting fully in, in the other.

The picking shoe is not always at its best when it is new; in fact quite often, probably owing to its position, it does not give a first rate pick at first, but after it has run a few days or weeks it begins to give a good pick; while in some cases it is not at its best until it is pretty well worn down.

If when a new shoe is put on it gives a good easy pick at the start the probabilities are that it will not last very long.

I have previously mentioned the proportionate movement of the pick to that of the lay. Now when the shoe is worn down sufficiently to give that proportion it is at its best and will stay there for a long time if it is not disturbed. In a great many cases they never reach that condition.

Generally the pick should commence when the crank is straight up, but in weaving very tender filling it is better to have it start a little

earlier so as to give the shuttle more time to get through the shed; thus enabling you to take off a little power.

"THE CAUSE OF OCCASIONAL WEAK PICKS." Who is there that has run a section of looms for any length of time, particularly the kind that takes the short picking shoe, that has not been bothered at times with a loom banging off about once in half an hour or so without any apparent cause? And the question has often been asked, "What is the reason?" Some say it is the belt or the friction that is slipping. Perhaps that is partly the cause, but there is something else; because, if you take particular notice, you will find that it always happens out of the same box.

Others lay the blame on the speed or shafting not running steady; but in this case I should like to know how they account for the loom in front and the one behind running all right; they are run from the same shaft.

I am satisfied that the principal cause is in the picking shoe, which is in such a condition that it will do its work right so long as everything else is right. But there is one of the binders that is not shaped right, though that alone is not sufficient to cause it to bang off; but if the belt or friction should happen to slip just on the moment when the shuttle is being

picked out of that particular box (which they are liable to do at any time), then there is a combination of three things acting simultaneously, which might not occur once in ten minutes but when it does it results in a weak pick, and the loom bangs off.

Now if the position of the shoe could be changed, or a new one put on that would give a more perfect stroke, so that no part of it would sustain a loss of power, nor receive any extra strain, the trouble would be entirely overcome.

CHAPTER III.

THE SHUTTLE BINDER.

The binder, though it looks so simple, plays a very important part in the running of a loom ; if it is not shaped properly it may not only fail to check the shuttle the same every time, but also effect the delivery.

There may be a good strong pick delivered out of one box and a very poor weak one out of the next.

A good binder will receive the shuttle and check it properly under a varying speed, while one not properly shaped and in poor condition would allow it to rebound a little when the speed is high, and perhaps not let it get well in when it is a little lower.

Then again, if the picker is pretty well worn, the shuttle tip would stick in it and either cause the box to jump or prevent it from dropping. The remedy often applied in this case is to chip the picker around the hole when the real cause of the trouble is the binder. All fixers will at times remedy the effect, but a good fixer will get at the cause as much as possible.

Of course the effect of the shape of the binder on the running of a loom depends a great deal on other things in connection with it. For instance, some looms seem to go all right with any old shape of a binder, while others will not go at all unless they are just so. A great deal depends on the kind of a pick the loom has got.

Take it on a loom where the picking motion is not in good condition, you will find a great unevenness of power. There will be a good strong pick out of one box, while another one will always give a poor weak pick. And yet you can make a good even pick out of every box by simply shaping the binders properly if you know how to do it.

On the other hand, if you let the binders stay just as they are and put on a new picker-shoe, you will get quite a different pick, one on which the binder does not seem to make any difference.

Writers on this subject differ extremely on the way a binder should be shaped to give the greatest satisfaction. Some say that they should be bent so that the greatest curvature will be in the centre, or in some cases nearer to the mouth of the box.

Others say that there is but one correct way to bend a binder and that is to have it bear on

the shuttle as near the heel of the binder as possible.

It is amusing, if not interesting, to see the excellent string of reasons in support of their statements.

In theory, it is no doubt advisable that the binder be bent so that the most prominent part will be near the mouth of the box, but in practice we find very few fixers who bend them that way.

If it is bent too prominently near the mouth of the box it will give the shuttle too great a shock before it has got half way in, and the rest of its course is accomplished too easily, so that the least variation in power may cause it either to rebound or not get quite to its destination.

If the loom ever throws a crooked shuttle it is liable to be checked with the tip an inch or more outside the box, thus hindering it from dropping and causing the shuttle to fly out. It will also cause the shuttle when entering the box to swing outward enough to strike the box edge and cut the filling.

The best way to bend a binder in my opinion is so that the shuttle at its full width will come into contact with it about three inches from the center, that is, at the commencement of the binder's full surface, and

steadily press it outward until the shuttle gets the same distance past the centre, at which position the binder will be out to its full extent. Thus the binder at its full depth of surface, and the full length of that surface only, will come into contact with the shuttle. Binders that are bent properly on this principal will give the shuttle a steady, gradual check, and not cause the opposite end to strike the edge of the box and cut the filling.

As far as checking the shuttle is concerned, there is more than the shape to be taken into consideration. The surface should bear evenly on the shuttle all the way along, that is to say, that part of the binder which comes into contact with the shuttle. If some part of it is bearing on the shuttle very hard, while in other places it barely touches, it will be in a poor condition, whether the most prominent part is nearest to the mouth of the box or to the other end.

Note.—See Chapter XVII.

CHAPTER IV.

LOOM BANGING OFF—CAUSES, RESULTS AND REMEDIES.

A loom that is constantly banging off is sure to have a serious break sooner or later if it is not stopped.

Amongst the numerous breaks that are caused in this way may be mentioned : the protector casting underneath the breastbeam ; teeth broken out of the driving gears ; broken crank shaft ; the side frame, and a host of other things too numerous to mention. While the different things that will cause a loom to bang are fully as numerous or more so than the breaks that are a direct result of it. But whatever is the cause there is a remedy for it, though both the cause and the remedy are sometimes hard to find. The principal causes are friction or belt slipping especially on heavy work ; too short a sweep ; poor pickerstick ; shuttles not getting well into the boxes or rebounding ; loose bolts or castings pertaining to the picking motion, etc.

If the cause is not apparent, the first thing to do is to see that the belt and friction are

doing their work properly. This can easily be seen by the way the loom runs and how it starts up. The remedies for these can be found in the first chapter.

Generally the stroke should come up to within two inches off the bunter, but to get the best results it may have to be varied a little according to circumstances. One loom will have a fine pick if it comes up to within one inch off the bunter, while on others it will need to be at least one and one-half inches shorter. Good judgment is needed to obtain the best results.

The next thing to be done is to go around and examine the castings, bearings, studs, etc., and see that they are all secure. Then start the loom and watch the shuttles as they go into the box, they may seem to be all right for awhile and then one of them may not get clear up to the picker, or it may rebound and bang off the next pick. If it is rebounding the binder is at fault; but if it does not get well in it may be the binder or a weak pick. The shuttle may be unduly retarded by too close a shed.

An uneven pick may be the result of a combination of circumstances, in fact a large per cent. of the problems which a fixer daily encounters are caused by a combination of two

or more causes ; different parts of the loom which are so adjusted that on account of the relative position or condition of some other part, will not work just right.

Many a time does the fixer go about the loom readjusting different things which he thinks may have some effect on the trouble, and all unconsciously he breaks the combination, and the trouble is apparently remedied. The next thing to be done in this matter is to examine the pickerstick, and if you find it badly worn by the picker, chip it out with a hammer and wood-chisel so that it will not bind underneath or above the picker. If the stick is cracked or split — so that it is not reliable, replace it with a good one, the best you have got. I am speaking now of chronic cases, where the loom has been bothering you for some time and when you are or ought to be getting down to business in good shape with a determination to conquer.

See that it throws a straight shuttle ; you will find instructions on this subject in Chap. VIII. If the shuttles themselves are crooked or worn out of shape, either put in a new set or straighten them up by rubbing them on a large sheet of sand paper laid flat on a good floor or on a straight board made purposely for the job. Some fixers prefer to use a plane ; it makes no

difference so long as you get them straight. See that they are all the same size.

Whenever a fixer has a job of this kind on his hands he should put as much time as possible around that loom until he is perfectly satisfied with it and not be in a great hurry to get away from it. If he has to leave it temporarily, let him return to it again and he will ultimately conquer if he has got enough gumption for a loomfixer.

When a fixer is working around a loom he may save himself a great amount of future trouble by promptly attending to any little matter which he should happen to notice going amiss, on the "stitch in time saves nine" principal.

When putting on a pickerstick he may notice that the pickerstrap or powerstrap is nearly worn out or breaking, in which case he should put a new one on while he is at it and not wait for it to break or it may break something else.

Some of the gears which run the handmotion may be just a little loose, and it is a great temptation to let it go, it does not seem to be doing any harm ; but if it is allowed to run that way very long, it will spoil the key way so that it will be difficult to get a good fit when it is

fixed and it will have to be fixed sooner or later anyway.

The fixer who attends to little matters like these promptly, will keep his section of looms in good condition ; but the man who lets everything go as long as it will, is letting them get all run down, for which the weaver suffers as well as the production of the mill.

Another thing which should not be overlooked in this matter is flat-sided pickerballs.

CHAPTER V.

FILLING AND WARP KINKING.

Filling kinking generally can be stopped by one or more of the following remedies: tightening up on the binders or shaping them so that the shuttle will not rebound; reducing the power on the pick if it will stand it without banging off; getting a good tension on the filling so as to keep it tight; and setting the harness cylinders well forward so as to close the shed early.

But there are cases of filling kinking sometimes, which for a time seems to defy all attempts to remedy them; in which case the fixer must get down to business with a grim determination to conquer at all cost.

In the first place get the loom into good order, paying particular attention to the picking motion. If you can get a good smooth even pick you will be able to run with less power on than would be possible with an ugly jarring pick as there is always a certain amount of irregularity and unevenness in connection with such a pick.

If the shuttles are not all alike there must be a general straightening up of them. It may be that there are some odd ones amongst the set that are worn rounded, on the back or bowed in at the front and so forth ; straighten them up either with a plane or otherwise. Next put a good sized brush into them so as to get as much tension on the filling as it will stand comfortably.

There are other ways of getting extra tension on the filling besides the regular way of putting waste in ; one way is to take a small bunch of bristles out of the hand brush and fix them into the side of the shuttle so that the ends will rest on the bobbin at the nose.

Another way is to tack a piece of thick felt about an inch square into the shuttle near the eye, and run the filling through it, first having punched a hole in it for that purpose. This is practical only on fine yarn. Set the bottom cylinder about seven teeth ahead of the box motion, and the top one about three or four ahead if circumstances will allow. On some weaves it will cause the filling to kink close up to the selvedge if the top cylinder is set more than two or three teeth ahead ; also on heavy work it may cause the boxes to jump, especially on old looms. It will no doubt seem strange to a fixer who has not had a wide experience,

talking about the setting of the harness cylinders causing the boxes to jump, but it is a fact, nevertheless, and there are a great many queer things about a loom besides that.

It happens on some weaves that the harnesses change only from one position, that is, from top to bottom or from the bottom to the top only. In these cases the shed does not close on the pick as quickly as it would in ordinary cases where the harnesses change from both positions. The filling has a tendency to kink on that account, especially on piece-dyes where there are no risers after the backing pick. The trouble in this case can be overcome by having the listing harnesses change on that pick.

It is sometimes very difficult to stop filling kinking on goods that have a fine tight weave on the face and a loose back. Each backing harness rising about one pick in eight, makes it kind of loose on the backing warp and is liable to have a few slack threads in the shed, and on account of the filling being so light, it easily kinks on them.

In this case if the backing warp is on a separate beam, the whip-roll may be lowered to advantage so as to draw the threads tighter on the top side. But if it is a one beam warp (which is often the case on this kind of weaves)

the best way would be to drop all the backing harnesses and raise up the face and put a lease rod through. Fasten it back about fourteen inches from the harnesses.

The general idea among loomfixers is that the early closing of the shed would prevent the filling from kinking by closing on it before the shuttle is stopped, thus catching the filling before it had time to get slack. Such is the case only to a certain extent as the early closing of the shed effects it a good deal further than that.

For proof of this, take a case where there is about half a cut woven with the shed changing late, and set the cylinders well forward for the rest of the cut, and notice the difference in the width of the cloth on the roll. It will be found to be about an inch narrower, the reason for this is that the filling is taken up more in cloth woven with an early shed than with a late one. The slack of the pick is taken up evenly along the entire width, or at least is spread out more so that it becomes unnoticeable, while in the former case the whole slack may be taken up on a single thread or in one place and thus becomes a kink.

Cloth that is woven with the shed closing early will be a little narrower but longer to the same length of warp than would be the case

with the shed closing late with the same tension on in both cases, because in the former case the filling takes up more and the warp less than in the latter. Of course the difference will be very small in some cases; it varies according to the weave.

When it is necessary to set the bottom cylinder forward as much as seven teeth ahead, care must be taken that it does not connect with the vibrator gears before the levers get clear down and the lock-knife in. To prevent this it may be necessary to set the claim shaft a little earlier and perhaps the cam which operates the lock-knife. This cam is set on the shaft with a small pin, but often it has to be cut off so as to move the cam; it will hold without the pin.

KINKS ON THE WARP THREADS.

Warp kinking may be overcome by adjusting the cylinders and whip roll, chiefly the former, and keeping the warp tight. Generally, setting the cylinders back a little is all that is required. When the backing and face warp are both on one beam, and the back weave is loose and the face tight, the whip roll may need to be lowered a trifle.

CHAPTER VI.

FILLING CUTTING.

There are two distinct kinds of filling cutting. Firstly, the kind that is done in the cloth by the beating up of the reed; secondly, cutting that is done outside the cloth through some defect of the loom or shuttle. In the first case the fault is probably in the filling being too delicate or tender to stand the strain that is brought to bear on it by the heavy beat of the lay, which is necessary to get the required number of picks in per inch. It occurs chiefly where heavy weight goods are made with a fine weave and fine single yarn filling.

It is a very difficult job to remedy this trouble by the adjustments of the loom as there is generally a tendency towards filling kinking on this class of goods, the remedy for one being antagonistic to that of the other. Perhaps the best way to set the cylinders in this case is about four teeth ahead on the bottom and even with the box motion on the top. The filling will probably need steaming to take the curling propensities out of it, so as to better overcome its tendency to kink.

In such cases as this, if the management could see their way to take out about two or three picks per inch, and reduce the number of threads in the warp, so as to allow of making the filling a little more substantial, it would improve matters a good deal.

If the warp is poorly dressed, some of the threads would probably be slacker than others which would put extra friction on the filling, while others would be just as much too tight, being so much stronger than the filling, would cut through it.

There should be care used in the selection of a reed for this class of goods. A V shaped edge on the wire is not just the thing in this case, it is a little too sharp.

Filling cutting that is done outside of the cloth is caused in most cases by being caught between the shuttle and the entrance of the box. It may be the shuttle that is going crooked and striking the box edge, or the box may be too low, causing the shuttle to swing outward at its outer end, thus striking the edge of the box and chop the filling.

If the filling is cutting in one particular box the probabilities are that the binder is the cause. To find out if such is the case, take the binder out and put it into the next box where the filling is not cutting, and put the

other one in where it is cutting and watch the results.

If it don't cut any more in either box it shows that the binder in combination with some other defect was causing the trouble ; but by changing binders the combination was broken. If the filling cutting follows the binder into the other box, then it is clear proof that the binder is the sole cause, of which take due notice and govern yourself accordingly.

But if on the other hand the cutting still continues in the same box as before, it is hardly likely that the binder can have anything to do with it, and it would be advisable to look elsewhere for the cause.

If the cutting cannot be stopped in any other way it can be accomplished by putting a leather collar around the edge of the box, if that is the place where the filling is cut. It should be about one-eighth of an inch thick, one inch wide, and put on good and tight.

But perhaps a better way, or at least better looking and more durable way of fixing it in this case, is to file the mouth of the box where it is cutting the filling on the lower half only, thus the shuttle will only strike it on the top half. Very little filing is necessary to accomplish this if it is done in the right place. Some-

times when the picker is giving out in some place it will cause filling cutting.

The pins in the shuttle side or the shuttle eye will cut it if they are sticking out too far. If there is any sharp or rough places on the box or shuttle race where the filling could get to, they should be filed off and rubbed down smooth.

The temple will cut it if it touches the reed or shuttle race. It should be set clear of these anyway as it would spoil either of them if allowed to strike against them.

Amongst other things that will cause the filling to be cut or broken may be mentioned a bruised spot on the face of the binder ; or a broken eye or splinter in the shuttle.

There is a kind of filling cutting which happens very rarely on worsted goods unless it is coarse and heavy, but often on woolen goods if the filling has been wound on a winding machine.

What I refer to now is cases where the filling flies around in the shuttle too much, increasing its liability to get caught anywhere in the box when the shuttle is being picked out. There is a cause for this of which the fixer has no control, consequently too often he must remedy the effect. It is far better to remedy the cause when it is practical and that

is in having the filling wound the opposite way.

I imagine some critic who does not know any better, pooh poohing this, and asking what difference the way the filling is wound can make to the wearing of it. Now I have had my schooling on this subject as well as others and know just what I am talking about. If twist filling is wound contrary to the twist, it will fly around in the shuttle a great deal more than it would if wound the right way, that is the way of the twist. That is to say, the way that it would be if it was run onto shuttle bobbins on the twister in the first instance.

But if it has been wound over again, the wrong way, and the result of it (filling cutting) has got to be remedied in the loom, perhaps the best way to do it is to bore a small hole in the side of the shuttle and fix some bristles in to it in such a way that the ends will rest on the tip of the bobbin. This will prevent it from flying around too much.

CHAPTER VII.

THE FILLING STOPMOTION

To adjust the parts: — Bring the lay forward until the dagger gets close up to the knock off finger No. 8, when it is held up to the limit. Then set the breast-beam, stand so that it will just touch the dagger and no more. Next, push the lay back and pull on the shipper handle, having previously disconnected it or knocked the belt off. Then adjust the fingers on the shipping rod which runs parallel with the breast beam, underneath, so that the one on the right hand side of the stand will bring the knock-off finger up to the limit, and the one on the left-hand side to bring the guard lever, (on the old style) one eighth of an inch below the top of the frame. Next set the dagger, raising slide so that the feeler wires will clear the shuttle by about three sixteenths of an inch; and so that there will be three eighths of an inch space between it and the knocking off finger.

On the later style of stopmotions, the dagger guard is made to be raised with a steel spring,

when the shipper is released; and that is the time to make the adjustments. If properly adjusted, the guard will positively protect the knock-off finger for the first pick when starting up, whether the filling is under the wires or not. It is a great improvement on the old style.

THE KNOWLES' FILLING STOPMOTION, though such a delicate piece of mechanism is simple in construction and very rarely gets out of order unless some of its parts are worn down too far.

In case of trouble on account of it failing to stop the loom properly, first, see that the feeler wires are straight and not too long, and that all the parts can work freely; not being choked up with waste and dirty grease. If the trouble is not found there, see that the dagger touches the breast-beam stand between the bottom of the slide and the knock-off finger, but not to rest on it too much or it will be liable to rebound over the top of the finger, especially if the dagger or finger has got the corners worn or rounded off; in which condition the dagger should be filed square or replaced with a new one. The No. 8 casting should be ground down square at the top corner, it is too hard to file. The dagger is also liable to rebound if the socket casting is worn down in the bearing

so that it wabbles sideways, if the dagger strikes or rests too much on the frame. If these things are attended to, and other parts properly adjusted and secure, there should be no trouble on that score.

But there is another way in which any stop-motion will, under some conditions annoy both fixer and weaver, and that is when it unnecessarily stops the loom too often. This is most in evidence when the filling is too light or soft to stand sufficient tension to draw it properly under the wires, on heavily threaded warps that are of a long-hairy nature. The course to be adopted in this case is to keep the warp pretty tight and have a good sized shed, and a good tension on the filling. Do not allow the shuttles to rebound nor to box too easily.

See that the catch does not slip too easily on looms that have the brake attachment, and that the lock-lever on the shipping motion does not release too easily where there is no brake attachment. Some fixers claim to have completely remedied this trouble when everything else has failed, by cutting the hole deeper into the lay, into which the feeler wires drop, and taking full advantage of it in lowering the breast-beam stand.

The frequent stopping of a loom is not always caused by the filling motion; sometimes

the corner is worn off on the lock-lever, allowing the shipper to gradually release itself; in which case the former should be taken off and filed down so that it will lock itself securely.

Another thing that will sometimes stop the loom occasionally is the connecting rod which runs underneath the lay, when it is held too far forward or too low, so that it strikes against the knock-off finger. If such is the case it can be felt by putting your finger onto the end of the trigger behind the shipper handle.

Or if the protector strikes against it once in a while on account of the binder not being held out far enough, by taking hold of the end of the trigger you can feel the bump in either case.

In cases where the stop-motion lets one or two broken picks go by without any apparent reason, you should be careful to see that the casting No. 8. comes fully up to its limit, because if it does not, in some cases the dagger will slip off the end of it once in a while before it has pushed it back far enough to do its work.

THE POSITION OF THE ROCKER ARM: The loom stopping unnecessarily too often, is sometimes caused by there being not enough motion on the dagger between its position when the wires are resting on the filling

and when they are clear down; hence the practice resorted to, of cutting the hole deeper as stated above.

Now this can be accomplished in most cases if not all, where it is necessary, without cutting the hole deeper. But to explain clearly to such as have never thought of this matter, it would be as well to point out the fact that the amount of motion between two points depends on the position of the rocker arm; that is the small arm which raises the wires. If it is nearly perpendicular when the wires are down, it will communicate very little motion to the dagger to raise the wires level with the bottom shed. But if the arm is set so as to be nearly horizontal between these two points, there is the full length of the arm of a leverage, which will give all the motion that is necessary. Thus whenever you contemplate cutting a deeper hole in the lay to get a greater motion on the dagger, just try raising up the rocker arm a little or as much as it will allow and you will be able to get all the motion you want. Of course this will require a readjustment of all the other parts in connection with the breast beam stand and on the shipper rod.

CHAPTER VIII.

CROOKED AND FLYING SHUTTLES.

The causes of a crooked shuttle, or shuttle going crooked, are quite different from the causes of the shuttle flying out; of course in aggravated cases the shuttle may go so crooked as to fly out, but that is the exception rather than the rule.

Some looms have a chronic trouble of throwing the shuttle crooked once in a while, though in a great many cases it never does it so bad as to send it flying There are other cases where the trouble dates back only to the starting of the warp, or to some other alteration.

In the first case it may be caused partly by a bad pick which causes too much of a jerk on the loom, the crank arms are probably loosely connected, which would allow a certain amount of shakiness on the lay. These two together may be enough to divert the shuttle materially from its course if not to cause it to fly out altogether.

The hole at the inner end of the picker-rod may be so far worn out as to throw the rod out

of its proper pitch. If it is closer to the box at its outer end than at the reed end, the tendency will be to throw the shuttle away from the reed ; whereas if it is too much the other way, though its tendency would be toward the reed it would be liable to rebound on account of it being too much that way, especially if the lay is too loosely connected and shaky. The picker-rod should be set pretty near true with the boxes, but just a little further off at the outside end than at the inside end ; about one sixteenth of an inch should be sufficient.

Then again the lay end may be out of true. In trueing up the lay end the box and shuttle race should come perfectly level, if the loom itself is set level ; which can be determined by putting a level on the breast beam and back girt. The picker slide should be properly in line with the box, and just as level. A straight line, perfectly parallel with the box should have a tendency towards the reed of about three eighths or one half an inch at the width of the loom.

When this trouble dates back only to the starting of the warp, the cause is probably in the reed, but possibly in the shed or boxes if there are more boxes in use than before. An unsteady box motion may be the cause. The shuttles may need straightening up and the

binders getting into better shape. A new picker or even a new pickerstick may be needed.

When a new warp is put into a loom, care should always be taken to see that the face of the reed comes perfectly even with the box guide. If it does not come up even, it should be brought forward sufficiently by means of a strip of leather or card board put in between the reed cap and the lay sword. But if the reed comes too far forward there is too much packing used in the setting of the lay end, and some of it should be removed. On looms of recent date the reed may be set forward or backward by means of the adjusting screws which may be found alongside of the screws for tightening up the reed.

Whenever a new set of shuttles are put into a loom, if they do not strike the hole in the picker properly there should be new pickers put on as well.

A poor shaped binder in combination with an ugly pick are as likely as anything to be the cause of this trouble.

PACKING OUT THE PICKER ROD STAND: When it is necessary to pack the picker rod stand out on account of the hole in the lay sword being worn out too far, leather packing being generally used, it is necessary that it be tapered off a little thinner on the side

nearest the pickerstick than on the outer side, because the bolts, being nearer to the outer edge would draw it out of line with the hole for the other end of the rod, if the packing was the same size on both sides.

SHUTTLE FLYING OUT. This thing rarely occurs on a well kept loom unless it is by accident, such as a broken picker-stick, or picker strap, or a thread getting entangled in the shed in such a way as to hinder it from opening properly. In some cases the shuttle stops once in a while with the tip an inch or two sticking out of the box and the result is the box does not go down and it flies out. This is caused generally by an uneven pick or a badly shaped binder, probably both. The shuttle sticking in the picker is another cause, the remedy for which you will find in Chap. IX. A hard pick in combination with a shaky lay and a poorly shaped binder will often cause the shuttle to fly out.

CHAPTER IX.

BOX JUMPING.

This is a subject on which it is very difficult to write so as to correctly instruct one how to proceed to remedy the trouble.

Happily it is something which does not often occur ; but when it does, it is a problem that occasionally gives a fixer a great amount of trouble. He may work on it for hours ; yes and days, off and on, and do everything that reason, experience, and other fixers could suggest, and find the problem still there unsolved. I have seen such to be the case more than once, and seen it completely stopped in about two minutes after everything else had failed, by a thing almost so simple as to appear ridiculous.

Of course it does not often happen that way. This brings to my mind one case in particular where the fixer had done everything in the way of setting the harness cylinders, putting on new gears and so forth to take the vibration out as much as possible all to no avail.

They seemed to get into position with a jump on the upward motion. I noticed that the top

box-cylinder was fully a tooth behind or later than the bottom cylinder, so I suggested that there be a small piece chipped off the next tooth on the bevel gear so as to allow the top cylinder to be set forward one tooth ; it was done so and there was no more jumping there. Two minutes work, if it had been known at first what was wanted. The boxes will jump in their downward motion, on very heavy work when there is a high number of harnesses used, if the harness cylinders are set in a certain position. That is, when the bottom cylinder is set about seven teeth ahead, and the top one, two or three ahead, the boxes are liable to work unsteadily in their downward motion. But if the top harness cylinder is set back a couple of teeth, they will work steadily. This is something which does not appear as if it ought to affect the box-motion but it does nevertheless ; probably on account of the lurch in the headmotion when the heavy strain of striking the shed is suddenly released at a critical point. This kind of box jumping does not occur much on looms where the head motion is driven by eccentric gears because the motion can be set to accommodate the needs of the case.

A great many of the troubles mentioned in this book are things that are peculiar to old

looms and consequently do not occur much on looms that are comparatively new, or if they do in some cases, the extreme remedies mentioned for use on old looms are probably not needed.

There are some things that may be necessary to be done in cases of this kind of box-jumping, the fixer to use his own judgment as to which is most needed in his own particular case. They are, such things as the various gears and connections between the driving power and the headmotion being either worn down, loose, or not deep enough.

There are a great many connections between these two points and if they are all worn down even a little, it amounts to quite a trifle altogether ; "every mickle makes a muckle" as they say in Scotland. It may be advisable to put on two or three new gears where they are worn down the most ; or the fixture block in the clutch arrangement may be loose, in which case the upright shaft should be taken out and a new key fitted in. The same thing should be done in all cases where the fixtures that are keyed on have worked loose.

The gears should be meshed as deep as possible, not to bind. By these means the vibration of the headmotion cylinders may be reduced to a minimum. Another kind of box jumping is caused by the shuttle sticking in

the picker. The shape of the binder is to a great extent responsible for that, because if it is not shaped so as to check the shuttle to the best advantage, it will need to bind harder than is necessary under proper conditions. The box slide or guide, nearest the reed should be square with the shuttle race, because if not, the boxes may have a tendency to bind under very little obstruction.

The setscrews at the bottom of the lay sword may happen to become loose, they do once in a while, and allow the rocker casting to get out of line, and bind on the box rod tube with the result that the boxes do not drop properly.

See that the packing behind the picker is big enough for the picker to just clear the shuttle.

BENDING THE BOX-ROD. In some cases where the shuttle boxes do not set level it is advisable to bend the box rod just a little to bring them right. When this is the case it should be bent at the top, close to the casting so that the entire length of the rod below it will still remain straight. A very little alteration will generally be found sufficient.

It is seriously wrong to try to make the boxes set level by the adjustment of the guides, because in that case they do not have an even bearing on the supporting arms; hence they are liable to bind on the slightest provocation.

CHAPTER X.

BOBBIN SPLITTING. FILLING KNOCKING OFF. THE TEMPLE.

BOBBIN SPLITTING ON THE LOOM is caused by the shuttle striking the top of the box between the bobbin nose and the shuttle point, the momentum of which causes the spindle to jump up and catch the bobbin on the end of the box shelf or top; but what causes it to do this is the problem that the fixer must solve. Usually all that is necessary is to level up the boxes even with the shuttle race and lower the shed if it is too high; but there are obstinate cases that require further treatment. When this is the case, it is generally caused by the loom throwing the shuttle crooked in such a way that when it is going through the shed it resembles a boat on the sea; up and down. In the first place, the shuttles may be old and not only badly worn down but very much out of their proper shape; in which case they need a thorough straightening up or replacing with a new set. Some fixers claim to have found it necessary to take the race plate off and plane

the lay down on account of its being sprung out of true, but I do not think that is ever necessary on a Knowles loom. Anyway, whatever makes the shuttle go crooked, it will be worse if the picking power is too strong. It may be necessary to get a different kind of a pick on the loom by changing the position of the picking shoe, and getting a good smooth pick on the loom in general. The vibration or shakiness should be taken out of the lay as much as possible, and the top cylinder should not be set too far ahead.

FILLING SLIPPING OFF THE BOBBIN.

It sometimes happens that the bobbins are too soft either through the fault of the yarn or the spinner, and the loom fixer has a hard job to make them weave without the yarn slipping off in lumps, causing a great amount of waste and lost time. When this is the case there should be an extra effort made to reduce the power on the pick if such a thing is possible. The loom should be made to pick as evenly as possible. It stands to reason that if there is an uneven pick, it will either knock the filling off when the pick is too strong or the loom will bang off when it is weak ; perhaps both.

There are quite a few things that will cause the pick to vary in strength. If the shoe is so far worn down or out of its proper position as

to necessitate the setting of the sweep stick very low down on the pickerstick to get power enough, the pick is not to be depended on, as the least slipping of the belt or friction would make a great deal of difference to the pick. A slipping belt or friction will make a difference anyway but as this subject is treated fully in the first chapter, it is not necessary to dwell on it here.

Great care should be taken in shaping the binder that it is not made to check the shuttle too suddenly at the commencement nor allow it to box too easily.

Do not have the packing behind the picker too hard ; it should be more in the nature of a cushion in this case.

Get the shuttles to go as straight as possible so that they will not strike against the side of the box.

The weaver should press or knock the filling down hard on the bobbin before shuttling.

THE TEMPLE. Almost any weaver can set an up-to-date ring temple so that it will do its work in ordinary cases, but on weaves that are either extremely loose, tight, or delicate, the fixer's skill and experience has got to be brought into action.

It frequently happens on light picked goods that the first (smallest) ring of the temple

marks the cloth, and even if it is taken out and the space left vacant the next one will take up the strain and leave a mark just as bad. In this case it can be greatly helped by taking the second ring out and putting the first one in its place, leaving the first place vacant. Do not set the barrel up very high. There are times when the fabric is of such a delicate nature that all the rings will leave a mark. In this case the best way to fix it is to take them all out but the two largest, and give them a hold of the selvedge only. They will be found sufficient in goods of this nature.

In heavy weight goods that have a very tight weave it is sometimes a hard job to make the temple hold the cloth out to its full width, on account of it taking up so much. In such cases everything has got to count. The temple must be set well in, so as to give it a full hold on the cloth. The barrel must be set up pretty close to the cap. It must be set forward as near to the reed as possible without touching it. It is customary to run a strip of sandpaper about four or five inches wide around the sand roller on each side to keep it tight, if it has a tendency to get loose. I do not think there is anything gained in this case by pointing the temple in any degree towards the breastbeam, and certainly not towards the reed.

Do not set the cylinder any farther forward than is necessary.

It is possible to turn the ring holders back a little from their regular centre position, and it is sometimes advantageous to do so in extreme cases like this, but if such a thing is resorted to, the cloth will have to be kept tight or it would lose more in its backward movement than it gained.

CHAPTER XI.

THE HEADMOTION.

The setting of the headmotion in some cases is of as much importance to the work in the loom as the condition of the picking motion is to the running of the loom.

It is not necessary nor advisable to go over the ground again with regard to the way the headmotion should be set in making the different classes of goods, as that is discussed in other parts of this book, chiefly in connection with the different subjects on which the setting of the headmotion can have any effect. But I will here endeavor to discuss the principal troubles that a fixer occasionally has to deal with in connection with the same. To a learner it is a very complicated piece of mechanism, nevertheless it is a beautiful motion throughout, and to one who thoroughly understands it, it is simplicity itself.

Still, there are times when an old headmotion will be very near too much even for a good fixer, unless he goes to work and replaces the principal parts with new fittings, such as vibrators, cylinders, lockknife, gears, etc.

Harness skips are the principal trouble in connection with the headmotion; the different things that will cause them are too numerous to mention, and in some cases very difficult to find out. Take it on an old loom where you are using twenty-six or thirty harnesses, half of which are flopping up and down about every pick, on a heavy job to boot, things have to be got down pretty fine, as in these cases the loom will make skips on the least provocation or, to the fixer's mind, without any provocation at all. A great cause for harness skips in such cases, and one which very few young fixers would ever dream of being the cause, is the pin or shaft which supports the vibrator lever, when it is bent a little, but not enough to be noticed when the levers are all on, also when it has worn the hole about one-eighth inch too big in which it sets.

The best way to fix this if it is worn down pretty bad, is to have a new bar turned out and have it made with the head a little larger than the old one; and as the hole in the frame is worn out of shape it should be reamed out to fit the head of the bar. But if it is not worn down much, nor badly bent, it would be just as well to turn it half way round, tighten it up, and plug up the loose end with a piece of sheet metal of some kind. If the bar is badly bent,

but not worn much, it should be taken out and straightened. It is sometimes advisable on heavy work like this to put a little more spring on the lock knife if it is being forced out by the strain on the levers; or, if the knife is badly worn in some places, it should be replaced with a new one. When there are a few of the first teeth on the vibrator gears that are half worn through, they sometimes cause the lock knife to be forced out, which results in skips.

If the last tooth in the vibrator cylinder is worn through in some places it may possibly fail to properly deliver the vibrator to its destination, thus allowing it to fly back again. On light work it may be made to go but it is not always safe on heavy work.

Rivets sometimes work out and get mixed up among the gears, cause a skip, and then drop out of sight, leaving the fixer to hunt for the cause of the skip.

A crooked bar in the chain may cause a racket in the headmotion and sometimes a skip. It should be replaced with a straight one.

Vibrator levers that are crooked or sprung out of their proper shape may bear against the next one on either side and prevent them from dropping quick enough. The space allotted for each of the vibrators is necessarily very small and consequently does not allow of much

crookedness. Harness skips made in this way will be on the face, as the harness stays up one more pick than is called for, in fact, hardly ever a skip is made on the back, unless there is a broken ball on the chain. This is the reason why the Knowles loom has such a reputation for making so few harness skips, because whenever they are made they can be so quickly seen and remedied.

Whenever a large number of harnesses are used and there is trouble with harness skips, it is a good thing to take all the vibrators out and fix them up good and true, filing the tips, tightening the rivets that hold the chills whenever such things are needed, replacing badly worn gears, etc.

Occasionally cases will be found where the oil and dust have been allowed to dry on, or get so thick and gummy that it prevents the vibrators from working freely. When this is the case they should be well cleaned while they are out. If there are any broken teeth in the comb they should be taken out and fixed or others put in.

Harness skips are sometimes caused by the vibrator gear rebounding and flying back, thus letting the harness down again before the shuttle has got clear through the shed. In such cases there will be a short skip near the edge of the

cloth on the back. Too much vibration in the driving power of the headmotion is the principal cause of this. Some of the gears or other connections must be either loose on the shaft or worn down on the teeth, consequently the top cylinder gives a lurch, landing the vibrators too quickly. To remedy this the connections between the headmotion need overhauling. If any of the gears, etc., are loose on the shaft they need a new key fitting in. Do not depend on the setscrews to hold them. Perhaps the teeth are worn down a little but not enough to need a new gear, but would stand setting a little closer, thus reducing the amount of play considerably. If the headmotion is driven by eccentric gears, it may be the best policy to set a little more on the slow motion at the point of delivery. Sometimes setting the top cylinder back a little will fix it all right.

Such things as harness skips, loom-banging, etc., require not only gumption but experience to properly locate the cause; a bright experienced fixer would locate the cause of such things instantly in a majority of cases, while one of little experience may fool around for days, altering everything but the right one, and, even when it is fixed, it is often, to some extent, by chance. Those who have been there can well remember how it was.

In adjusting the headmotion, the lock knife should get in before the first tooth on the bottom cylinder engages with the vibrator gear.

The object of the lock-knife is to hold the vibrator gears into the bottom of the cylinder while working, thus preventing the possibility of harness skips by slipping out.

The cam which operates it is held in a fixed position on the shaft by means of a small pin which is fixed into the shaft and fits into the cam. But in some extreme cases it is necessary to set the cam a little earlier and to do this the pin has got to be cut off. By driving the cam forward with the hammer, it will cut the pin itself and make itself such a tight fit by so doing that there is nothing further needed to hold it.

SETTING THE REVERSE GEARS.

Turn the cylinder crank so that the lock-knife will be clear out and the finger in the center of the cam ; then turn the chain shaft so that the vibrators will be in the center position, that is, half way up and down. Then mesh the gears with the key ways in a straight line so that the reverse knob or key will slide either in or out without moving the gears. New looms have setting pins in the teeth of the gears which simplifies matters considerably to learners, but one often comes across old looms where the pins have been knocked out for some reason or

other, in which case they have to be set according to the above directions.

SETTING THE BOX MOTION. Different fixers have different ways of setting the box motion. I think the majority of them set it to move about one-fourth inch when the protector strikes ; while others don't go by the time they begin to move, but by the time they get to their destination. Personally, I have always found it to work satisfactorily to have the cylinders set so that the last tooth of the box motion part of the cylinders will be in a perpendicular position when the loom begins to pick.

ANOTHER VERSION. Bring the lay forward to the protection, loosen the two setscrews that fasten the spur gear on the bottom shaft, and with the clutch at bottom of upright shaft locked, turn the cylinders forward until the box rises one-fourth of an inch, then fasten the setscrews.

In running with skip boxes where the head-motion is driven by eccentric gears, the boxes should be operated on the slow motion, but getting well onto the quick motion when they are getting to their destination. The reason for this being, that in big jumps the boxes in their downward motion would not keep up with the chain if they were started on the quick motion, but would catch up with a jump about

the time they get to their destination ; but if they are started on the slow motion, they just keep the chain tight all the way down.

The length of motion of the boxes is adjusted by sliding the movable bolt at the center of the long lever, or the movable slide at the top of the short lever.

Another thing about the headmotion which sometimes bothers a beginner is when the chills, through some cause or other, do not come just right over the chain shaft, with the result that the first tooth of the cylinder gear does not strike deep enough into the vibrator gear, but gets deeper as they turn around. The headmotion is then in a condition to wear the gears out very quickly. This condition of things may be brought about by the heel shaft supporting the vibrator levers being sprung.

Then again, on turning the cylinder crank back after raising the harnesses, the last tooth on the top cylinder gear may strike the teeth on the box vibrator gears on account of their not going down quickly enough. This may be caused by the key-way in the reverse gears, or the key itself being worn down so badly as to allow of too much play in the gears, and consequently lost time on the chain shaft. Thus if it is set right for the forward motion it will be too late on the backward motion. In this

case it needs a new reverse key or new reverse gears, or both.

The vibrator gears, in their connection with the cylinder gears, communicate the motion to the jacks, and are so constructed and arranged that as the cylinder gear engages with the vibrator gear the motion communicated to the harness is very slight and easy at first and increases until it passes the center, then gradually decreases to the other extreme of its motion. This would not be noticed by a casual observer on account of the high speed that the looms are run at, but its effect is there nevertheless. It is a beautiful motion and is one of the important points of a Knowles loom, on account of the ease with which it enables the harness to handle the warp. The cylinders are chilled in casting and are very hard.

The vibrator gears are made of the best "boiler plate" iron, punched out, turned down to the proper size, and cut by machinery expressly for the purpose, then case hardened all over. They should work as deep into the top cylinder as possible to work nicely. This will not affect its position with reference to the bottom cylinder.

The bevel gears which run the headmotion are all "keyed" on the shaft. The key is first fitted into the shaft and then filed down enough

to give it a good tight fit all the way along. The gear is then driven onto it. Thus the gears can be driven off the end of the cylinder shaft without first removing the key. Most of the gears on a Knowles loom are fastened in this manner, likewise the friction pulley. Those where the key is driven in afterwards are the large driving gears, and the inside gear on the spur shaft. The spur gear on the bottom shaft is fastened by means of two set-screws and is adjustable.

CHAPTER XII.

PUTTING A WARP IN. WEAVING UNEVEN. SOME CAUSES OF SHADY PIECE DYES.

Before putting a warp in, the fixer should look the loom over to see if it needs fixing anywhere where it would be difficult to get to with a warp in the loom.

There are also certain places that should be properly oiled, but in too many instances are grossly neglected. Such things as the harness-strap pulleys, both on top and underneath. Places underneath the breast-beam and around the stop-motion. It somestimes happens that the back stands or bearings for the shoe shafts are neglected so much that the end of the shaft is almost worn off, and the hole about twice too big.

Every fixer must know that it is impossible to get a good smooth pick on a loom that is in that condition. Of course the weaver will tell you she oiled it up twice a day, morn and noon. The fact of the matter is, they don't take the trouble to find whether the oiling places are choked up or not, but fixers can save themselves

a great amount of work and supplies for the mill by keeping a sharp lookout for these things when the loom is empty.

Before hooking the wires or straps onto the harness underneath, the pulleys at the bottom corner should be let in about an inch. After they are all hooked up, the wires should be carefully evened up so that they will be all very near the same tightness, and then the pulleys should be screwed out again as far as is necessary. On heavy work they need to be screwed out pretty tight or there will be trouble on the top with the stirrups moving up or down on the jacks.

While discussing this subject it would perhaps be as well to mention the various kinds of streamers in use in different mills for connecting the harnesses underneath.

In some mills a large V–shaped wire is used to hook on to the harness with a strap running from the center around the bottom pulleys connecting it to the wire underneath. In other places the whole business is leather, from the harness to the bottom wire. This kind is too elastic or springy and on heavy work there is too much lost motion.

But the style that gives the greatest satisfaction in the writer's opinion are those made with about ten or twelve inches of

leather to hook onto the harness and connected with a small V-shaped wire, from the center of which a strap extends around the bottom pulley in the usual way. Any breakages in this case do not get entangled amongst the harnesses as is possible in the first style.

In putting the reed into position the bottom clamp should be drawn up close before the reed cap is tightened up, and then tightened up afterwards. The reed cap should not be pounded down onto the reed as it would be likely to spread out some of the dents or otherwise make the reed uneven. Care shoud always be taken to see that the reed comes just even with the guide plate.

UNEVEN WEAVING or light and heavy places in the cloth are caused generally by the friction bands not letting the warp off evenly. The strip of cloth which is lapped over or tied around the beam head is often the cause of this on account of it being kept on too long. It should be changed when it gets dirty or glazed, otherwise it will stick very tenaciously to the beam head like a belt with a good pulling surface, and when it has got to let go, it does so with a big jump. It is sometimes necessary to put some powdered blacklead onto them, or rub them well with a block of stove polish, chiefly

on light weaves. It is customary in some mills to do it in all cases.

There are other things which sometimes make the cloth come out uneven, but they are not regular occurrences. Take for instance a two beam warp; the top lever may be set too high so that it presses against the whip roll, or it may be too low, and rest on the beam head. In either case it may cause a varying tension on the backing warp which in some weaves makes a great difference to the appearance of the cloth. These things should be adjusted so that they will work freely without any obstruction. Then again, I have seen it where the flange on the bottom has touched the floor in some places and just cleared it in others. Such things are liable to give the fixer trouble in locating them, as at the time he goes around inspecting the beam to see that it is not resting on the, floor he finds it apparently all right, clearing nicely by an eighth of an inch. Perhaps the best way to fix this matter is to pack the beam stand out at the bottom,about three eighths of an inch. Shady or apparently uneven cloth may be caused by the warp beam being untrue. But in this case it is hardly ever noticed except on light striped trouserings, woven with dark filling, in which case it shows up a trifle shady once every round of the beam, and has the ap-

pearance of being caused by shady or uneven filling.

The beams for this class of goods should be trued up occasionally. This can be done by means of the three rods which run the length of the beam.

The Crompton and Knowles loom works can supply the paraphernalia for doing this.

The class of goods that are the most troublesome in regard to light and heavy places are usually those that are extremely light ; woven light. The least variation in the tension of the warp shows up in the cloth.

There is another thing about this class of goods which it is pretty safe to say is not thought of by a majority of the fixers at the present day, or up to the advent of this book, and that is, that on account of the easy tension of the cloth on the sand roller, it becomes possible for the bottom or cloth roller to pull harder than the sand roller, especially at the commencement of the cut.

Of course it can't pull the sand roller around any quicker but as there is some amount of play in the gears which run it, there will be the same amount of variation in the take up ; resulting from the sand roller being sometimes turned by the gears and at other times by the cloth roller.

Moral: Do not have the cloth drawn tighter below the sand roller than it is above it.

SHADY PIECE DYES. The cause of shady piece dyes can very seldom be traced to the loom, though there are manufacturers and superintendents who claim that on certain classes of goods, if the temple does not hold the cloth out somewhere near the full width, the filling is not only drawn tighter on the sides than in the middle but the warp is chafed more, and on that account takes the dye differently, thus making what is called shady piece dyes.

In hooking the harness rods up, the heddles should be carefully and properly divided so that they will not chafe the warp. It does not show up much on the loom but in some cases it shows up very streaky after it is finished.

CHAPTER XIII.

TO ADJUST AND START A NEW LOOM. THE POSITION OF THE WARP ROLL. HOW TO HANDLE BAD WARPS.

TO ADJUST AND START A NEW LOOM. First set it perfectly square with the line shaft, and properly levelled up by placing a level on top of breastbeam and loom sides so that the shafting will not bind.

Use three and one-half inch belts.

They ought to run empty a few hours to limber up, during which time they should be thoroughly oiled in all the working parts.

POSITION OF THE WHIP ROLL. The normal position of the whip roll is so that a straight line from it to the breastbeam would pass exactly midway through the center of the open shed, but in odd weaves it may be varied a little to advantage.

For instance, take it on a weave where there is two or three times as much warp on the bottom shed as on top; in this case the threads on the top side of the shed would be tighter than those on the bottom, which if it was a very delicate warp, would seriously effect the

weaving of it ; so that in this case it would be better to raise the whip roll enough to even up the tension on both sides. Then there are other times when one side of the shed could be run tighter than the other to advantage. As an instance of this I will mention the case of a double weave with a loose back. There is probably one-eighth of the backing warp up, each pick. Now to get a clear shed on the backing warp in this case, it is necessary to have the threads on top rather tight so as to draw them clear off of the bulk of warp on the bottom shed. In this case only the backing warp whip roll would need lowering.

HOW TO HANDLE BAD WARPS. It not unfrequently happens that the fixer is called to a loom on account of the warp weaving badly, or the thread breaking too much.

His first move in this case should be to examine the condition and position of the broken threads.

If they are a clean cut between the harnesses and the fell of the cloth the probabilities are that the shuttle is the cause. To find out which one is causing the trouble and where the defect is, close the shed and push each shuttle slowly through the mass of warp threads, both ways. By so doing, if there is anything on

them that will catch hold of the warp threads, you will be sure to find it.

The cause of the trouble can usually be located by simply looking the shuttle over, but this way is not quite as sure as pushing it through the warp. At the same time examine the rivets at the heel of the shuttle spring underneath. In shuttles that are old and worn down they sometimes stand out below the level of the woodwork, in which case they would strike the race plate and thus chop the threads down more or less. This matter can generally be fixed by filing the rivets down a little.

If the broken threads have the appearance of being worn down the chances are that it is the fault of the adjustment of some part of the loom to some extent, aggravated possibly by the shuttles being rough in some places.

Of course the yarn itself may be poor or not have enough twist in it, so that it is necessary that the friction on it in the loom should be reduced to the utmost limit.

The first thing to be done in this case is to get a good even shed; not to have the threads on one harness about half an inch higher or lower than the rest. The shed should be large enough for the shuttle to go through without touching the top part of it, and the bottom part should not bear down too hard on the shuttle

race. The loom should be made to throw a straight shuttle.

The shuttles should be rubbed smooth with fine sandpaper and some shellac put onto them. Do not have the shed to close any earlier than is necessary.

TENDER OR TWITTY YARN. Next we have warps that are too tender or twitty to do their work without breaking a great deal; in fact it seems sometimes as if they won't stand looking at. These kind of warps break out most behind the harnesses and the chances are that the fixer will not be able to do much for it. There is, however, one or two things that he should guard against in such delicate work as this. If it is necessary to have the shed closing early, care should be taken to see that the changing harnesses do not reach their destination at exactly the same time the reed or lay is at its extremity in beating up the filling. Because, to put the reason as plain as possible, it will be observed that when one harness gets to its lowest or highest position it draws the threads tight, and if the momentum carries them a little beyond the set position (which in most cases it does) then there is extra strain brought to bear on the threads; also when the lay is beating up the filling it usually brings a little extra strain onto the warp. Now, then,

to have both the lay and the harnesses bringing their strain to bear on an extremely tender warp at exactly the same time, stands to reason that they will have a bad effect on the weaving of the warp.

The best way to avoid it would be to set the bottom cylinder far enough ahead for the harnesses to get down just ahead of the lay in beating up, and the top cylinder a little later so that the harnesses going up will not reach their destination until the reed begins to recede from the cloth. It would be better if circumstances would allow to have both cylinders set later than the reed.

CHAFING AND BUTTONING BEHIND THE REED. This trouble can be prevented to some extent by having a good sized rope made of yarn to move back and forth with the lay on top of the warp between the reed and the harnesses. It is a good thing to wet it at intervals when the trouble is very bad.

The harnesses should be set far enough back so that the lay will not bump against them, particularly in this case.

CHAPTER XIV.

CHAIN BUILDING. CAUSES OF PICKER-STICK SPLITTING. BROKEN PICKING ARMS AND OTHER THINGS.

CHAIN BUILDING, in a great many of our fancy worsted mills, is an item of study which, in the writer's opinion, does not receive due consideration. I think almost all fixers will agree with me in the statement that in too many cases the person whose duty it is to make out the chain drafts does not study it sufficiently to give the best possible boxmotion. The result is that there are more skip boxes or bigger jumps than is necessary, and the shuttles that are used the most are running into a blind box all the time or, at least, a great part of it.

There seems to be a sort of impression on their minds that the boxes on both sides should work exactly in unison with each other; that is to say, if it is necessary to have a big drop on one side there must be a corresponding jump on the other side. This not only causes more wear on the loom, but also more work for the fixer and some annoyance to the weaver.

It may be advisable to work it that way on

looms that pick on both sides every pick, but there are a great many looms now in use that have the sliding picking motion on. It is a great improvement to a loom ; there is a better pick, it runs lighter, and there is less wear in general.

When a person has a complicated chain draft to make out, he should study over it carefully and try it different ways so as to get the best possible results, both for the weaver and the loom, and not rush it through in any shape.

Now about the setting of the links, different chain builders have different ways of doing this. Some put both links inside on one bar and outside on the next. Others place them one inside and one outside on every bar; in fact, any old way will go on chain stuff that has been worn awhile, though even in that case it is safer and just as easy to have some system and uniformity of arrangement. But when it comes to new chain stuff, they being made to fit so snugly, it is absolutely necessary to have some regularity in the way the links are put on, so as to prevent the chain from gathering up under the vibrator levers and causing a smash-up.

Also, it will be observed on examining the links closely, that they are not perfectly flat, but that in the punching out process one side is made slightly concave while the other is correspondingly rounded, consequently, if the links

are carelessly put together and should happen to come back to back, the chain would work so stiffly that there would be danger of it gathering, as before stated. Thus, when the chain stuff is new, the links should be carefully put together with the rounded side of one to fit into the hollow of the other.

Now while we are on this subject, it would perhaps be as well to mention another item which is destined to become an important attachment to the fancy loom in these days of large overchecks, plaids, etc., and that is —

"THE CHAIN MULTIPLIER." Its usefulness may be imagined to some extent when one goes through a weave room and sees about half of the looms running with a chain on about seven or eight yards long, very nearly all of which is simply a repetition of some eight or twelve bars.

Now we will take for example a pattern that is woven four and four on two shuttles about seven times over before the overchecking comes in.

There are 56 bars if run on the regular chain but if the multiplier is used, it would be accomplished with 14 on the regular chain and 8 bars on the mutiplier; 22 in all.

One bar is required on the regular chain for every movement of the boxes. Where the

fancy part of the chain comes in, it has got to be built in full on the regular chain.

The multiplier chain operates one lever only and is all blanks with the exception of a "raiser" which is required whenever a change in the boxes is called for, consequently the amount of labor in building it is greatly reduced.

Its workings are accomplished by means of two star wheels and the necessary finger cams for operating the same, only one of which is in operation at the same time. It is not necessary to explain its workings in detail further than to say that when the pattern does not require a long chain, or when the multiplier is not needed, it can be disconnected and the regular chain is in operation without any further complication.

Pattern looms in particular should be fitted up with a chain multiplier on account of the great amount of chain building that is required in a pattern room.

They can be attached at any time, though not originally put on.

PICKERSTICK SPLITTING. It would hardly be advisable in this work to try to enumerate the many different things that will cause the pickersticks to split or break in general, as the fixer can in most cases find that out for himself. But there is one way in which a great

many of them that are broken could be avoided, and that is when they are being split at the bottom.

It does quite frequently occur that one loom will split about three pickersticks in as many days and continue doing it if the loom is not fixed, or unless it should happen to get one of extraordinary strength. This is most in evidence where the short shoe is used, that is, on looms of the two to one gearing style.

In such cases perhaps the best way to remedy the trouble would be to first try to ease up on the binders a little if they are binding very hard. It will probably be necessary to alter the shape of them a little to accomplish this. Next select a good sized soft pickerstick bunter and put it on. Then select a good likely pickerstick and wrap it good and tight towards the bottom with a narrow strip of leather, or (as some fixers prefer) put a rivet through the bottom and that will, in most cases, fix it all right.

But in case that is not sufficient, you will have to either adjust the picker shoe differently so as to obtain a smoother pick, or put on a new one. If the loom is picking very hard (ugly), it would be as well to do this in the first instance.

PICKING ARMS BREAKING. There

are a great many more picking arms broken in some weave shops than in others; fixers who have moved around much must have noticed this.

A good fixer may work a long time in one place and scarcely ever have one broken, and he may go to another place to fix the same style of looms and he will have one or two broken every week.

In large mills where there are two or three weave looms of the same kind of looms and using the same supplies, it has been noticed that in some rooms there are scarcely any broken at all, while in others it is a regular occurence, and the question has often been asked: "What is the reason?"

The writer has worked in a good many weave rooms. Some of them were good high rooms, requiring the use of a long belt for the looms, while others were very low, necessitating the use of short belts; but he has never noticed any great amount of breakages except in the latter style of rooms, where the looms were run with a very short belt. He consequently feels satisfied that the cause is the rigid running of the loom on account of there being an insufficiency in the give of the belt.

This applies more especially to looms where the two shafts are equally geared.

THE BOX ROD AND SPRING. It not infrequently happens that the spring on the box-rod has worked in one position so long that it has worn grooves in the rod at the bottom to such an extent that it binds on the socket or tube; consequently, if there is any obstruction to the rising of the boxes, something has got to break.

Thus, if at any time there is a broken lever which raises the shuttle boxes, or a broken casting under the lay end which carries the supporting rolls for the lifter chain, or a broken chain, the chances are that it is caused by the box-rod being stuck in the above mentioned manner.

This can be easily and quickly set right by turning the spring around so as to get it out of the rut.

These springs are tempered so that they will close right up and still spring back to their full length; but if such does not happen to be the case they should be drawn out again. They should never be packed up with an additional piece of spring or any other substance.

CHAPTER XV.

SHUTTLES. THE SAND ROLLER. TWO HOLES IN THE PICKER. FILLING CATCHING AROUND THE PICKER. OILING UP.

SHUTTLES: There are various things about shuttles which will sometimes annoy both the fixer and weaver if they do not properly understand them. For instance, we sometimes find one or two shuttles in an old set that don't go very well in a certain box, though they work all right in the other boxes. Not that the box is particularly wrong, because the rest of the shuttles work in it all right. Some weavers, when they find that to be the case, do not attempt to run a shuttle into a box where it does not go well, but will use it in the other boxes. That is to say, they will have a certain shuttle for a certain box and always use them in their own box. This notwithstanding the fact that they are all apparently the same size. By so doing they can save the fixer a little work and themselves some amount of lost time.

The cause of this difference in the working of the shuttles is not so much in their size or weight, but chiefly in their shape, and the condition of their surface where it comes into connection with the binder and the back of the box. This trouble can generally be remedied by shaping the binder a little different in the box where it occurs; but the best way to do, when a set of shuttles is in this condition, is to take them all out and straighten them up as near alike as possible. To do this some fixers use a plane, others a scraper, but the way that I have found to be most satisfactory is to take a sheet of coarse sand paper about 12 by 24 inches and lay it either on a flat place on the floor or on a board made purposely for the job, and rub the shuttles on it, on both sides. By so doing whichever part of the shuttle is most prominent gets rubbed off. Also their surface is very much alike. Take care to have them all the same when through. It wont do to straighten up one or two of them and leave the rest untouched. They wont work well together.

SHUTTLES FAILING TO HOLD THE BOBBIN. The cause of the bobbin slipping off the spindle catch, may generally be found in the shuttle, though often enough it is aggravated by the shuttle not being checked

properly. The catch-spring in the shuttle gets sprung too far open and does not hold on to the bobbin-head tight enough. In some cases it can be closed up enough without taking the spindle out; but if, when the spindle is down, the spring does not come up to the cross-bar, but stands off about one-eighth of an inch, the best way would be to either take out the wire cross-bar and close up the catch spring a little more or take the spindle out altogether and clean out the accumulation of dirt that has got there, and oil it well. At the same time open out the spindle a little so that the bobbin will be kept steady. It is a good thing to make it a practice, whenever you get a shuttle to fix, to put a few drops of oil on to the working parts if they need it, as the chances are that that is the only time they will ever get oiled.

THE SAND ROLLER. When the sand-roller is worn down so smooth that it will not hold the cloth any longer running in that direction, it can be made to go a while longer by reversing the gears and running it the opposite way. This can be done on worm take-up motions. The same results can be accomplished on the rachet wheel take-up by changing the sand-roller into a loom of the opposite hand. It is sometimes necessary to do this to keep

the looms going when there is not a new-covered roller available.

TWO HOLES IN THE PICKER. If the shuttle tip makes two holes in a new picker, the reason is that the boxmotion is set too early or the shuttle is getting in too late, perhaps both. If the bottom shuttle gets underneath the picker while the other strike it about the center, the probabilities are that the bottom cylinder is set too early. To set it back without disturbing the top cylinder you will have to cut a piece of the tooth out of the gear on the upright shaft, which communicates with the bottom cylinder so as to change it over a tooth.

FILLING CATCHING AROUND THE PICKER. There are very few loomfixers on worsted goods who are not bothered once in a while with the above complaint; and it is not the least of the troubles which he daily encounters. A good way to remedy it is to take the picker out and saw off the corner around which the filling catches and file it round and smooth. If that is properly done the filling will not get around it, or at least it will not hang onto it. Pickers that are too long are often the cause of this trouble. Of course if the shuttle tip is striking it too near the top or bottom and burring it in any way, it will catch on to the filling if it is not fixed.

Perhaps it would be as well in the first place to try putting in a good sized picker-stick bunter and as much leather packing on the spindle as the space will allow, not to have the stick bear on the picker.

OILING UP. Some weavers have a way of oiling their looms only in the holes that are bored out for that purpose (and not always there); never putting any on at the sides of the bearings, which of course is very seldom necessary if the holes are not choked up. The fact is they never seem to investigate whether the oiling places are choked up or not. The result is that the fixer is occasionally called over to a loom and finds the trouble caused by some of the bearings being completely worn down for want of oiling. Among the principal places that are commonly neglected may be mentioned the loose belt pulley. This is often neglected until it gets very hot or stuck altogether. A great many weavers don't seem to know that the place to oil it is the hollow ledge which encircles the hub. The fixer should draw their attention to it. Different places around the take-up motion and roller ends come in for a fair share of neglect. Weavers should oil their loom well when the warp is out, in places where it would be difficult to reach when the warp is in the loom.

Also have some oil left in their oil cans so that the fixer can put some on if he sees any place that the weaver has missed. The harness strap pulleys should not be overlooked.

On one style of heavy worsted loom, the driving gear on the crankshaft is not a solid fixture on the shaft; but two projections of it fit, each one of them between two blocks of solid rubber encased in a shell, which is a fixture on the shaft. This prevents the loom from stopping dead solid, with the exception of the lay, when it bangs off. Now a good many of the weavers (and some fixers for that matter) don't seem to know that this needs oiling on the shaft, consequently in course of time, it is so neglected that it becomes just as much of a fixture on the shaft as if it were keyed on and the first thing that the fixer knows about it is that the crankshaft is broken, and when he tries to get the gear off the broken shaft he finds that he has got a tough job. If he is possessed with enough reason and common sense he will know that this is the cause of the break.

CHAPTER XVI.

POINTS ON LOOM SELECTION.

The Knowles' heavy worsted loom is supplied in two styles, the equal geared and the two to one geared style. Perhaps a few words on this subject would not be amiss, coming as it does from a man whose time and experience as a loomfixer has been about equally divided between the two.

I am not sure what is the reason for manufacturers in some instances selecting the latter style, that is the kind where the top shaft is geared to run two revolutions for the bottom one, but I do know that the equally geared kind are nicer running looms and are less trouble to the fixer.

The difference is chiefly in the picking motion. Looms that are geared two to one require two picking balls on each side and a short shoe, which, by the way, gives a very nice pick so long as everything is just right; but it is very sensitive and will give trouble if things are not as they should be.

Now while I am on this subject it would be as well to bring to mind the fact that the set-

ting of the different parts of the picking motion of any fancy loom is quite an art and one that is not acquired in a day; that is, to get the best results. There is no fixed rule to work by, consequently the greater part of it must be set according to the fixer's best judgement. Thus the more sensitive the motion, the greater will be the effect of a piece of poor judgement.

A good steady uniform pick is very desirable on all looms, but in making fancy worsted goods it is a necessity. The difficulty in obtaining and maintaining the same is far greater where two picking balls are required than with one.

I will also say to mill managers who, to some extent make their own supplies and castings or have them made for them, that the picking shoe is a very important item in the make-up of a loom and it does not pay to have them home made.

HOME MADE SUPPLIES. One of the troubles with shoes that are not made at the loom works is that they do not all hang alike on the shaft.

The square hole which should fit good on the picking bar has got to be filed out considerably and it is very seldom filed out true, the consequence of which is that the circle or curve is

thrown out of its true position, which causes more or less of a jar on the pick. I may also say that the race of the shoe is a good deal harder when made at the Knowles' loom works and consequently lasts longer, than if made elsewhere.

THE TAKE-UP MOTION. These looms are also supplied with two different kinds of take-up motion, the "rachet wheel" and the "worm gear." The former is by far the handier of the two in all ways, but it admits "pumping" by the weaver which, if allowed to be carried on, is detrimental in some cases to the eveness of the goods.

It can be used either "positive" or "conditional." The action of the "worm gear" take-up is "positive" only.

THE SINGLE PICKING MOTION. The Knowles loom can be supplied with the sliding picking cam arrangement and it is a good thing, as with this device the loom only picks on one side at the same time, so that there is a great amount of saving in the wear of the loom. They also run nicer as there is not as much strain on the loom to jar at every pick.

On fancy work where two or more shuttles use the same box there is less chance of having a smash through starting up with the shuttles in the wrong box.

CHAPTER XVII.

GETTING AND KEEPING A SECTION OF LOOMS IN GOOD CONDITION.

Now we will begin by supposing that your section is all run down, that as a result you are kept on the go from morning till night and don't seem to be able to get the best of it. either through lack of time or ability on your own part.

The reason for this condition of things is that whenever a difficult job presents itself, it is so much easier to fix it for the time being by a little patch-work than to make a permanent job of it, which would take an hour or two ; and as it has the appearance of being a very big job, you, being very busy with other jobs, fix it in the shortest way. Thus it gets from bad to worse until if you would like to set to and make a decent job out of anything, you are so much crowded with other things that are on your mind, that you have no choice but to patch up, if it can be made to go at all.

Furthermore, whenever you have some difficult problem to solve, which all fixers have at

times, and which requires the concentrated energy of a clear mind, yours is too much occupied with a number of smaller annoyances on other looms and it cannot concentrate itself sufficiently on this particular case, consequently your work suffers and you are greatly handicapped.

This has not reference to cases where the section is altogether too large, but to those whose experience and skill is a little below the average, and who are attempting to make up for it by hard working.

I will now proceed to point out a line of action that will steadily build up your section into good condition and keep it there. I would not advise any man to begin overhauling them all as fast as he comes at them with the idea of putting them all into good condition at once, unless he had a large number of them stopped for some other reason.

I should go to work in an ordinary manner as I intended to continue ; something like this : We will suppose you have a job on the head-motion which to make a right job of it, would require all the vibrators taken out, a lot of fitting to be done, etc. But you can make a botching job of it in a few minutes which will go pretty fair for a day or two. What you

want to do in this case, if you have no other big job on your mind, is to get to work and make a thorough job of it, if it lasts half a day. When it is done, it will be done and your regular work will soon be caught up with. But, on the other hand if you have two or three warps coming out, and there is a loom making harness skips, or some other trouble which is bothering you to locate the cause, you had better patch it up and let it run until you get your warps in and overcome your other trouble, and then go to work on your big job and fix it; and while you are doing that, let the rest of your work take care of itself.

By following closely this line of action, though your work may seem pretty tough for a long time, you will ultimately become aware that your section of looms is gradually getting into better shape until by and bye you find yourself with plenty of time on your hands. So much so that whenever a big job turns up you almost always have time enough or are in a position to go right at it at once.

Your mind is not crowded as it used to be, and whenever a difficult problem presents itself you can concentrate your whole energy of mind onto it clearly and unhampered; you are master of the situation and your spare time is prolific. This is one reason for my contention

that it does not pay to crowd too much work onto a loomfixer.

Just the same with shuttle binders; under proper treatment their condition in general will improve. But if used in a careless, unskillful manner, their general condition must go worse. Now I will give what I have found to be a very good way of treating them. We will suppose the shuttle is going in too easily and rebounding. The binder needs tightening up a little. Of course the general rule is to hit it with a hammer or a four pound weight which seems to answer the purpose all right; but if you take particular notice, you will find in a great many cases, when there is a change in the atmosphere or speed, you have to ease up again on it. It will either give trouble by causing the shuttle to stick in the picker or by not letting it get far enough into the box. In using the binder in that manner, you are shaping it at haphazard. You may strike it right but the chances are otherwise.

What I consider to be a good way to do in this case is to take it out and examine its surface where it comes in contact with the shuttle. You will probably find that some parts of it have been bearing pretty hard on the shuttle while in other places it has scarcely touched. Therefore if you strike it on the back where it

L. of C.

needs it the most, you will be going in the right direction for getting a regular check on the shuttle. By that method of working, the tendency will be towards making the binder bear more evenly on the shuttle in all places, and not lightly in one place and very hard in another.

When a binder is shaped properly, and bearing evenly, it takes more than a little difference either in the speed or atmosphere to cause it to need tampering with.

Another way in which a loom gets run down and out of order outrageously fast is when the oiling of it is neglected.

But a fixer can work that part of it up into fair shape if he goes about it properly. It does not pay to be too aggressive in this matter, in fact a loomfixer should bear in mind at all times that the conduct of his weavers towards him is moulded to a great extent by his own conduct towards them.

If, when you are working around a loom you should happen to see a place that needs oiling, you can get the oil can and oil it; and if the weaver does not see you do it you can just draw his attention to it once in a while if it is occurring too often, and it will have its effect.

CHAPTER XVIII.

MISCELLANY.

No loomfixer, however bright he may be, or however much experience he may have had can say "I have nothing more to learn."

A good loom-fixer is a very valuable workman, but a poor one is dear at any price.

Do not be afraid of the weaver doing a little fixing for himself, rather encourage him.

A good way to crack or break the bottom out of the shuttles, is to be always battering the binders with the shuttle in the box.

Don't explain to the weaver the reason why you do so and so to the loom to make it run, unless he inquires respectfully, with a desire to learn.

There is a great difference between a loom fixer and a machinist, and whenever a loom needs the attention of the latter, the loom-fixer should take the necessary steps to procure

one ; remembering that his duty is the adjustment of the different parts of the loom so as to make perfect cloth and plenty of it.

It is a big mistake and poor economy to crowd too much work onto the loom-fixer.

A well oiled loom needs fully twenty-five per cent. less fixing and repairing, than one that is neglected.

A loom-fixer is not always idle when he is sitting on the bench.

A little time spent in greasing the driving gears and other gears which run the head motion, with tallow, would be spent to good advantage. They need it. The regular loom oil is not sufficient for that purpose. It is also a mistake to use light spindle oil on a loom, they need something heavier.

The best of fixers may learn something from a novice.

It is sometimes necessary to remedy the "effect" without touching the cause ; but a good fixer will get at the cause as much as possible.

Pickers will last a good deal longer and give less trouble if they are kept in the oil tank a few days before they are used. A good way to do it is to get a string of them and knock all the blocks out. Then run the half inch twist drill through them all, and drop them into the oil tank. Fish them out two or three at a time as they are needed.

The fixer who is not master of his work will generally know when he sees a weaver coming, what the matter is. He knows that for so and so, it is the stopmotion out of order; and for another, that the loom is still banging off; or for another, he knows when he sees him coming that it is a case of harness skips again, and so forth. That man is not the master of his work but his work is the master of him, and he had better "gird up his loins" and decide at once whether such a state of things is to continue before someone else decides it for him and gives him a chance to look for a job more suited to his abilities.

This book is calculated to be of service to loomfixers in the many difficulties which they daily encounter and not to teach a person who is not a loomfixer how to fix looms, inasmuch as it will take a loomfixer to understand it and

put its teachings into practice. If a man cannot fix looms without a book, he cannot do so with one.

A good, experienced fixer will usually see in a moment what is the matter while an inexperienced man may never see the point.

It is better to be a successful loomfixer than an unsuccessful overseer.

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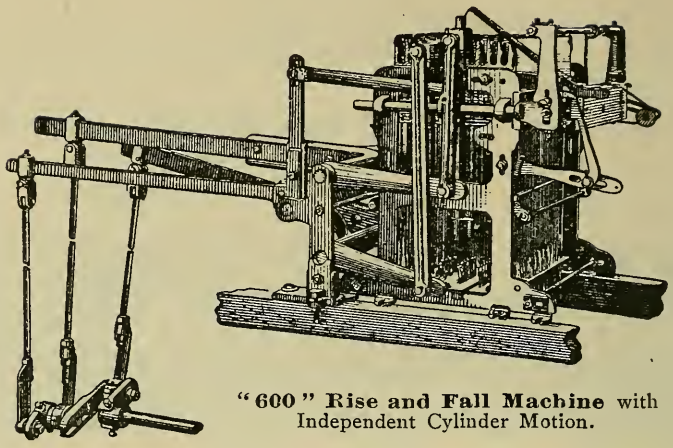

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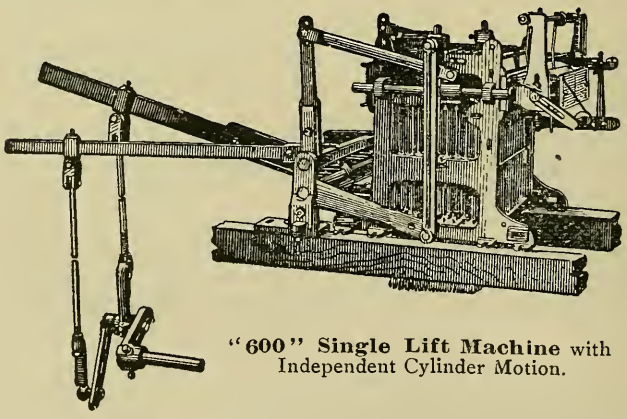

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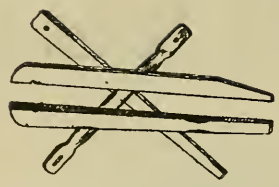

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